MACTEC ENVIRONMENTAL RESTORATION SERVICES, LLC

Spectral Gamma-Ray Borehole
Log Data Report

Log Event A

Borehole # 21-10-07

Borehole Information

Farm : BX	**Tank :** BX-110	**Site Number :** 299-E33-169
N-Coord : 45,369	**W-Coord :** 53,581	**TOC Elevation :** 656.51
Water Level, ft :	**Date Drilled :** 9/30/1971	

Casing Record

Type : Steel-welded	Thickness : 0.280	ID, in. : 6
Top Depth, ft. : 0	Bottom Depth, ft. : 100	

Borehole Notes:
Borehole 21-10-07 was drilled in September 1971. The borehole was completed with 6-in. casing at a depth of 100 ft. The casing thickness is presumed to be 0.280 in., on the basis of the published thickness for schedule-40, 6-in. steel pipe, which was typically used as casing during the early 1970s drilling campaign. Although no information concerning grouting or perforations is provided, it is assumed that the borehole was not grouted or perforated since this was not a routine practice during the early 1970s drilling campaign. The top of the casing, which is the zero reference for the SGLS, is approximately 0.5 ft below the ground surface. The present depth of the borehole was measured as 98.7 ft.

Equipment Information

Logging System : 2	**Detector Type :** HPGe	**Detector Efficiency:** 35.0 %
Calibration Date : 04/1997	**Calibration Reference :** GJO-HAN-14	**Logging Procedure :** P-GJPO-1783

Log Run Information

Log Run Number :	1	**Log Run Date :**	07/28/1997	**Logging Engineer:**	Bob Spatz
Start Depth, ft.:	98.5	**Counting Time, sec.:**	100	**L/R :** L	**Shield :** N
Finish Depth, ft. :	70.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Log Run Number :	2	**Log Run Date :**	07/30/1997	**Logging Engineer:**	Bob Spatz
Start Depth, ft.:	0.0	**Counting Time, sec.:**	100	**L/R :** L	**Shield :** N
Finish Depth, ft. :	8.5	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Log Run Number :	3	**Log Run Date :**	07/31/1997	**Logging Engineer:**	Bob Spatz
Start Depth, ft.:	71.0	**Counting Time, sec.:**	100	**L/R :** L	**Shield :** N
Finish Depth, ft. :	7.5	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

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Analysis Information

Analyst : H.D. Mac Lean

Data Processing Reference : MAC-VZCP 1.7.9 Analysis Date : 01/12/1998

Analysis Notes :

Three logging runs were required to log this borehole. A centralizer was used during all logging runs. The pre-survey field verification spectra for all runs and the post-survey verification spectra for runs two and three met the acceptance criteria established for the peak shape and detector efficiency, indicating that the SGLS was generally operating within specifications. The post-survey verification spectrum for the first logging run failed to meet the accepance criteria. However, this was considered to be a unique event that may be related to the high ambient temperature at the time this spectrum was recorded. Since logging operations are conducted in a more stable temperature environment, this failure is not considered to be significant. The energy calibration and peak-shape calibration from the pre-survey field verification spectrum for the first logging run was used to establish the peak resolution and channel-to-energy parameters used in processing the logging spectra. For logging runs two and three, these parameters were established from the pre- or post-survey field verification spectrum that most closely matched the logging run data. There was negligible gain drift during the logging runs; it was not necessary to adjust the established channel-to-energy parameters to maintain proper peak identification.

Casing correction factors for a 0.280-in.-thick steel casing were applied during analysis.

The only man-made radionuclide detected in this borehole was Cs-137. The contaminant was detected from the ground surface to a depth of 23.5 ft and at the bottom of the borehole (98.5 ft). Except for the upper 2 ft of the borehole, the measured contaminant concentrations were about 0.3 pCi/g. Measured Cs-137 concentrations in the upper 2 ft of the borehole ranged from just above 1 to 1.5 pCi/g, with the maximum concentration occurring at a depth of 1 ft.

The logs of the naturally occurring radionuclides show that the K-40 concentrations increase at a depth of 44 ft from a background of about 11 pCi/g to a background of about 17 pCi/g below this depth. The K-40 concentrations decrease to a background of about 15 pCi/g below a depth of 70 ft. The measured U-238 concentrations also increase perceptibly below the 70-ft depth.

An analysis of the shape factors associated with the logging spectra was not performed. The concentrations of man-made radionuclides in this borehole were not sufficiently high to provide a reliable shape factor analysis.

Additional information and interpretations of log data are included in the main body of the Tank Summary Data Report for tank BX-110.

Log Plot Notes:

Separate log plots show the man-made and the naturally occurring radionuclides. The natural radionuclides can be used for lithology interpretations. The headings of the plots identify the specific gamma rays used to calculate the concentrations. Uncertainty bars on the plots show the statistical uncertainties for the measurements as 95-percent confidence intervals. Open circles on the plots give the MDL. The MDL of a radionuclide represents the lowest concentration at which positive identification of a gamma-ray peak is statistically defensible.

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A combination plot includes the man-made and natural radionuclides, the total gamma derived from the spectral data, and the Tank Farms gross gamma log. The gross gamma plot displays the latest available digital data. No attempt has been made to adjust the depths of the gross gamma logs to coincide with the SGLS data.